Metamorphic development of aluminous andalusitestaurolite schist, Pubnico Point, Nova Scotia, Canada

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The Pubnico Peninsula, along the south shore of Nova Scotia is underlain by highly aluminous rocks of the Halifax Group which have been affected by high heat flow regional metamorphism, resulting in andalusite-rich assemblages. Isograds defined by the disappearance of staurolite, and appearance of sillimanite have been defined, with grade increasing from west to east.

Paragenetic sequences of the mineral assemblages in these rocks have been determined based on petrographic analysis. Among the porphyroblastic phases, garnet was the first mineral to grow, occurring completely or partially encased by other minerals present. Garnet grew early because it is spessartine-rich. Biotite was the second mineral formed, as relict biotite is found within staurolite porphyroblasts. Biotite was followed by the growth of staurolite and then andalusite porphyroblasts. The andalusite shows relict pseudomorph structures from staurolite grains, indicating that it likely formed due to the breakdown of staurolite to andalusite. In a narrow zone near the sillimanite isograd, a distinctive feature where andalusite porphyroblasts contain biotite boxes was encountered. Biotite boxes are composed of grains of biotite surrounding perfectly rectangular cores of andalusite, and are then encased by more andalusite. This indicates that the andalusite has two stages of growth, interrupted by the growth of biotite. Sillimanite formed after the growth of all other minerals, including biotite, as it is everywhere found in contact with biotite.

Microprobe analysis has been conducted on garnet, biotite, muscovite, plagioclase, andalusite and staurolite from six rock samples, from different metamorphic zones along the peninsula. One sample preserves a bathograd 2/3 assemblage of staurolite-andalusite-sillimanite-muscovitequartz, limiting the pressure of metamorphism to 3.5 kb. Preliminary analysis using winTWQ has determined the temperature of metamorphism ranges from 495°C to 585°C. Garnet grains present within andalusite porphyroblasts tend to have a higher temperature of metamorphism, 590°C, while garnet grains outside of andalusite porphyroblasts in the same rock have a slightly lower temperature of metamorphism, 550°C.

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